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Surgeon influence on receipt of contralateral prophylactic mastectomy: Does it matter who you see for breast cancer surgery?

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Abstract

Importance—Rates of contralateral prophylactic mastectomy (CPM) have markedly increased but we know little about the influence of surgeons on variability of the procedure in the community.

Objective—To quantify the influence of attending surgeon on rates of CPM and clinician attitudes that explained it.

Design and Setting—Population-based survey study in Georgia and Los Angeles County.

Participants—We identified 7810 women with stages 0-II breast cancer treated in 2013–15 through the Surveillance, Epidemiology, and End Results (SEER) registries of Georgia and Los Angeles County. Surveys were sent approximately 2 months after surgery, (70% response rate, n=5080). Surveys were also sent to 488 attending surgeons identified by the patients, of whom 377 responded (77% response rate).

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Main Outcomes and Measures—We conducted multilevel analyses to examine the impact of surgeon influence on variations in patient receipt of CPM using information from patient and surgeon surveys merged to SEER data.

Results—The patient mean age was 62; 30% had an increased risk of 2nd primary cancer, and 16% received CPM. Half of surgeons (52%) practiced for >20 years and 30% treated >50 new breast cancer patients annually. Attending surgeon explained a large amount (20%) of the variation in CPM controlling for patient factors. The odds of a patient receiving CPM increased almost 3-fold (OR 2.8, 95% CI 2.1,3.4) if she saw a surgeon with a practice approach one standard deviation above a surgeon with the average CPM rate (independent of age, diagnosis date, BRCA status and risk of 2nd primary). One quarter (25%) of the surgeon influence was explained by attending attitudes about initial recommendations for surgery and responses to patient requests for CPM. The estimated rate of CPM was 34% for surgeons who least favored initial breast conservation and were least reluctant to perform CPM vs 4% for surgeons who most favored initial breast conservation and were most reluctant to perform CPM.

Conclusion and Relevance—Attending surgeons exert strong influence on the likelihood receipt of CPM after diagnosis of breast cancer. Variations in surgeon attitudes about recommendation for surgery and response to patients request for CPM explain a substantial amount of this influence.

INTRODUCTION

Contralateral prophylactic mastectomy (CPM) for treatment of breast cancer has increased markedly over the last decade in the wake of greater patient awareness of the procedure. Today about 20% of patients receive CPM, representing about half of those who get any mastectomy, and rates vary markedly by region and by age.[1–3] Surgeons play a dominant role in advising patients newly diagnosed with breast cancer regarding their loco-regional treatment decisions.[1] Virtually all patients with curable disease see a surgeon and most patients are treated by the first surgeon they see. About two thirds of patients diagnosed with breast cancer receive a recommendation for initial breast conserving surgery (BCS) or mastectomy from their surgeon, and virtually all receive the recommended treatment.[4] Similarly, when a surgeon recommends against CPM, few patients undergo the procedure.[1]

Consensus statements by professional associations reinforce that CPM should be considered in patients at higher risk for 2nd primary breast cancer but discouraged in those who are at average risk.[5–7] Despite this, only about a third of patients at average risk of a 2nd primary who desired CPM reported a recommendation from their surgeon discouraging it.[1,8] Patients with the same risk of contralateral breast cancer may take in very different information and recommendations regarding CPM depending on which surgeon they see. However, no study has been published that examines the influence of the attending surgeon on variations in receipt of CPM in the community. Do patients with the same attributes get different treatment depending on which surgeon they see? What surgeon attitudes influence this potential variability? To address these questions, we used information from a large diverse contemporary sample of patients newly diagnosed with breast cancer and their attending surgeons to examine the influence of individual surgeon on the receipt of CPM.

METHODS

Patient Sample and Data Collection

The iCanCare study identified women with early stage breast cancer who were aged 20 to 79 years, diagnosed with ductal carcinoma in situ or invasive breast cancer, and reported to the Georgia or Los Angeles County Surveillance, Epidemiology, and End Results (SEER) registry. Surveys were sent approximately 2 months after surgical treatment between July 2013 and August 2015. Exclusions included: prior breast cancer, stage III/IV disease, tumors > 5 cm, or >3 positive lymph nodes. Patients were mailed materials and a $20 cash gift. We used a modified Dillman method to encourage response (median time from diagnosis to survey completion, 6 months, SD 2.8). We sent surveys to 7810 patients: 507 women were ineligible because they had exclusions noted above or were deceased, institutionalized or too ill to complete, or unable to complete a survey in Spanish or English. The survey was completed by 5080 of the eligible patients (70%) and linked to SEER data. The study protocol was approved by the University of Michigan, the University of Southern California, Emory University, and State Health Departments.

Surgeon sample and data collection

We identified attending surgeons through patient report. Nearly all patients (98%) identified an attending surgeon. Surveys were sent to surgeons towards the end of the patient data collection period (N= 488) and 377 completed them (response rate 77%).

Merged sample

We linked 3727 respondent patients with unilateral disease to 366 respondent surgeons. Of these, 116 patients were missing SEER data about stage or unilateral vs. bilateral disease. Of the remaining observations, 93% were complete in the variables we included in our analyses: 3353 women with stage 0-II breast cancer, without bilateral disease, and 349 surgeons. On average, there were 9.6 patients per surgeon (range 1 to 72).

Measures—The dependent variable was patient report of receipt of CPM. Patient covariates considered included age, risk of a 2nd primary breast cancer (following National Comprehensive Cancer Network (NCCN) guidelines and derived from patient report of age, detailed family history of cancer, and tumor characteristics)[9,10] and a variable indicating patient report of genetic testing results (BRCA). We also included geographic location and the date of diagnosis because both variables have a strong association with CPM receipt.

Surgeon variables considered included 1) a unique surgeon identifier, 2) report of the annual volume of newly diagnosed breast cancer cases treated, 3) age, 4) years in practice, and 5) gender. We hypothesized that surgeon differences in how strongly they favored initial breast conservation and how reluctant they were to perform CPM if asked by patient might explain some of the differences in whether patients received CPM. We developed two scales based on response to items in a scenario of a patient with localized disease and no obvious contraindications to breast conservation: 55 year old with no family history of breast cancer and normal screening mammogram. Bilateral screening ultrasound shows a 1.2 cm solid

mass. Core biopsy demonstrates infiltrating ductal carcinoma, ER 95%, PR 90%, and HER2-negative.

The first scale (favor initial breast conservation scale) was derived from 4 separate items: surgeons were asked (based on the scenario) if they would recommend for BCS, for unilateral mastectomy, for bilateral mastectomy, or *against* CPM (4-point response categories for each item, from definitely yes to definitely no). The items were scaled so that a higher score indicated favoring initial breast conservation. The second scale (reluctance to perform CPM if requested scale) was derived from responses to the question in the clinical scenario "Why might you perform bilateral mastectomy if requested by your patients like this?" Reasons for performing CPM included 1) give patient greater peace of mind, 2) improve cosmetic outcomes, 3) avoid conflict with patient, 4) avoid losing patient to another surgeon, 5) avoid need for surveillance, 6) improve long-term quality of life, 7) reduce recurrence of invasive disease, and 8) improve survival. Each item included a 5-point response category, from very likely to not likely. The items were scaled so that a higher score represented more reluctance to perform CPM

Both scales were developed using a partial credit item response model that allows the different items to have different thresholds for the responses and treats them as nominal, so that the response order can be tested.[11] The standardized latent scale from the model for the "favor initial breast conservation scale" had a reliability that ranged from .66 to .83 over the range provided by the surgeons in our study and was standardized to have a mean of 0 and standard deviation of 1. The latent scale for "reluctance to perform CPM if requested" had a reliability from .66 to .87 over the range of the response data and was similarly standardized.

Statistical Analysis—We first described the distribution of the patient and surgeon characteristics, the distribution of responses to the items that comprise the 2 surgeon scales, and distribution and correlation of the estimated underlying surgeon scale scores. The primary analysis was a multilevel logistic regression model with the surgeon identifier code defining the second level and the patient as the primary unit of observation.[12] Our base model included higher risk of 2nd primary breast cancer or known BRCA mutation (clinical factors for which guidelines recommend consideration of CPM), patient age (may capture some of the difference in patient demand for surgery faced by a surgeon and which is strongly associated with CPM) and date of diagnosis. We calculated the surgeon level variation in the base model after adjusting for our baseline patient predictors. Our second model step included the set of surgeon predictors described above. Only our two scale measures are shown in the model output as the other measures had small effect sizes and were not significant. We display the marginal effects of the two surgeon attitudes scale scores on the probability that a woman receives CPM averaged across the baseline set of covariates and the remaining effects attributable to the surgeons for our sample of women. Finally, in our third model step, geographic site was included because we had noted large site differences in rates of CPM and wanted to quantify the degree to which the surgeon differences we saw were attributable to a systematic difference in practice across geographic area as opposed to individual surgeon level variability with geographic area.

RESULTS

Table 1 shows the distribution of patient (1a) and surgeon (1b) characteristics. The patient mean age was 62 (SD 11); 28% had an increased risk of 2nd primary cancer, and 2% reported a BRCA mutation on testing; 16% of the total sample received CPM. Half of surgeons (52%) practiced for 20 years or more; almost one-third (30%) reported that they treated more than 50 cases of new breast cancer per year; and one quarter were female (25%).

Figure 1 shows the frequency of responses for the individual items in each surgeon scale. For the “favor initial breast conservation scale”, there was strong consensus favoring BCS (96%, probably or definitely, lower right figure) in the hypothetical case with no obvious contraindications to breast conservation. On the other hand, very few surgeons favored CPM (upper left figure, 96% probably or definitely not recommend), and a less unanimous but still substantial proportion would recommend against it (76%, upper right figure). There was wide variability with regard to the items that comprised the “reluctance to perform CPM scale.” Common reasons for performing CPM if requested were 1) to give patients peace of mind, 2) avoid patient conflict, and 3) improve cosmetic outcomes. Less common were to 1) avoid surveillance, 2) reduce recurrence, and 3) improve long-term quality of life. Least frequently endorsed were to avoid losing the patient or to improve survival.

Figure 2 shows the lack of a strong relationship between the two scales as demonstrated by the broad distribution of points representing individual surgeons in the scatterplot and the correlation of .30. There were a large number of surgeons who were relatively high on one scale and much lower on the other. There is some asymmetry in that while there are a reasonable number of surgeons who both favor breast conservation and are reluctant to do CPM, there is a much smaller number who are low on both scales. The two histograms show the distribution of surgeons across each scale on the respective axes.

Figure 3 shows the results of the three successive multilevel models including baseline patient variables, surgeon variables and site. The base model 1 (blue line, open circle) included elevated risk of a 2nd primary breast cancer (high risk), BRCA mutation, and age. Mutation status had a dominant effect with an odds ratio of about 6 (6.2 in model 1 to 5.8 in model 3) for CPM receipt when the women reports being mutation positive, and this estimate was omitted from the figure so that the other odds ratios are better compared (see appendix table 1 for the full table of model estimates). However, <2% of the women reported being mutation positive (Table 1).

Age was one of the strongest predictors after BRCA status, with a 50% reduction in odds of CPM for each decade increase in age. Overall, model 1 predicted CPM extremely well with an area under the curve (ROC) of 0.84 [0.83, 0.86] and the model explains 35% of the variability in the likelihood of CPM. Patient factors explained about 15% of the variability in the likelihood of CPM, but the surgeon identifier by itself explains even more, about 20% of the variance. The odds of a patient receiving CPM would increase 2.8-fold (95% CI 2.1,3.4) if she were to see a surgeon with a practice approach one standard deviation above a surgeon with the average CPM rate (independent of age, date of diagnosis, BRCA status and risk of

recurrence). In model 2 (red line, solid circle) we added the 2 surgeon scale scores for “favor initial breast conservation” and “reluctance to perform CPM”. Both substantially decrease the odds of receipt of CPM (adjusted OR 0.7 and 0.6 per s.d. respectively) and explain 25% of the surgeon influence. Finally, in Model 3 (green line, cross) we added patient geographic site, which is highly correlated with receipt of CPM: patients in Los Angeles County are much less likely to have received CPM (OR 0.5) and the variable explains a quarter of the remaining surgeon effect.

Figure 4 shows the independent effects of both attitude scales on rates of CPM in the population in model 2. The probabilities estimated the effect of changing the scale values in the population averaging over all the other variables and remaining surgeon variation. The x axis represents the score for the reluctance to do CPM scale (from least to most reluctant surgeons). The modifiers “most, more, less, and least” refer to one or two standard deviations on either side of the mean (average) scale score in our population of surgeons. The y-axis shows the expected CPM rate. The vertical layered lines indicate the effect of different reluctance scale scores on the favor initial breast conservation scale (least, average, and most favoring surgeons). So for example, 13% was the average rate of CPM for a surgeon who had average scores for both scale scores (center point on the orange line). But there was a wide variation in CPM rates based upon variation in these scale levels. At the extreme, the rate of CPM was 34% for surgeons who least favored initial breast conservation and were least reluctant to perform CPM (upper left point). By contrast, the estimated rate was 4% for surgeons who most favored initial breast conservation and were most reluctant to perform CPM (lower right point).

DISCUSSION

In our study we observed a striking influence of the attending surgeon on whether or not a patient undergoes CPM after diagnosis of unilateral breast cancer. The individual attending surgeon explained a large amount (20%) of the overall variation in CPM use in this large diverse population-based patient sample, after adjusting for factors that determine the risk of 2nd primary breast cancer and age, one of the major determinants of CPM. Surgeon attitudes about the approach to initial surgery or response to patient requests for CPM explained about a quarter of this surgeon effect. In a scenario of a typical patient with no contraindications to breast conservation and at average risk for a second primary cancer, a large majority of surgeons favored an initial breast conservation approach and a substantial majority would recommend against CPM. There was less consensus about the willingness to perform CPM if requested by the patient. We observed a range of reasons why a surgeon would be willing to perform CPM if asked: give peace of mind, yield better cosmetic outcomes, avoid conflict with patient, reduce need for surveillance, improve long-term quality of life, reduce recurrence of invasive disease, avoid losing patient to another surgeon, or improve survival (in order of endorsement). Both of the attitudes scales independently affected the likelihood that a patient would get CPM. This varied from 34% for the (relatively rare) attending surgeon who least favored initial beast conservation and was least reluctant to perform CPM if asked, to 4% for surgeon who strongly favored initial breast conservation and was most reluctant to perform CPM if asked.

We also examined pertinent patient factors. CPM was correlated with guideline-concordant clinical factors (elevated risk of genetic mutation or BRCA mutation on testing) and patient age, which may reflect physician and/or patient views that CPM is an increasingly more relevant alternative the younger the age of onset of breast cancer. Finally, the geographic location variable explained some of remaining surgeon variation, suggesting at least some regional surgeon peer effects and potentially a regional difference in patient population attitudes toward CPM.

Prior literature has demonstrated the marked increase in receipt of CPM after diagnosis of breast cancer and underlying factors driving the trend (dominantly greater patient awareness and interest for the procedure).[2,13–18] More recent research has shown that surgeon recommendation against CPM powerfully reduces receipt. But only about a one third of patients who consider CPM report that their surgeon recommended against it and one third reported no substantial discussion with their surgeon about it.[1,8] However, our study is the first to estimate how much the likelihood of a women receiving CPM varies across surgeon.

Aspects of the study merit comment. We used a large population based contemporary diverse patient sample with a high response rate. Virtually all patients identified their attending surgeon and surgeon survey response was high. The measures were highly relevant to clinical practice and the methods were appropriate to the research questions and study design. However, there were some weaknesses. Despite high survey response rates, there was inevitable decay in the sample given the requirement for completed surveys from both the surgeon and the patient. Finally, the findings were limited to large regions of the country.

Implications for patient management

Contralateral prophylactic mastectomy represents an important paradox in cancer management today. There has been a sea change in clinician attitudes about the approach to management of curable breast cancer favoring less extensive locoregional approaches. Yet, rates of CPM have increased over the last decade largely due to greater patient awareness and interest in the procedure. In this context, we found that the attending surgeon explains more of the variation in CPM than patient clinical factors. Surgeon attitudes about the options for initial surgery and their reactions to patient requests for treatment strongly influence whether a patient with similar attributes receives CPM. These attitudes could shape the course of the discussion about treatment with patients by influencing the strength to which a surgeon 1) endorses breast conservation as the initial surgery option, 2) feels compelled to discuss the details of CPM as a possible treatment alternative, or 3) tries to discourage a woman from CPM as a treatment. Our findings motivate the need to help surgeons address this growing clinical conundrum in the exam room. This has already begun as oncology surgeon associations revise and promote clearer guidelines about CPM.[5,6] Our findings reinforce the need to address better ways to communicate with patients with regard to their beliefs about the benefits of more extensive surgery and their reactions to the management plan including surgeon training and deployment of decision aids.

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Appendix

Table of model odds ratios for Figure 3

	Model 1	**Model 2**	**Model 3**
	O.R./95% CI	**O.R./95% CI**	**O.R./95% CI**
outcome: cpm			
High Risk	1.3	1.3	1.3
	[1.1,1.7]	[1.1,1.7]	[1.1,1.7]
BRCA	6.2	6.0	5.8
	[3.3,11.8]	[3.2,11.3]	[3.1,10.8]
Quarter(per year)	0.8	0.8	0.8
	[0.7,1.0]	[0.7,1.0]	[0.6,0.9]
Age (per decade)	0.5	0.5	0.5
	[0.4,0.5]	[0.4,0.5]	[0.4,0.5]
Conservative approach		0.7	0.8
		[0.6,0.9]	[0.6,0.9]
Reluctance to do CPM		0.6	0.7
		[0.5,0.8]	[0.6,0.8]
Georgia			1
			[1,1]
LA County			0.5
			[0.3,0.6]
Surgeon effect (per s.d.)	2.8	2.4	2.2
	[2.1,3.4]	[1.9,2.9]	[1.7,2.6]
N. of cases	3353	3353	3353

Key Points

Question

How much does the attending surgeon influence variation in receipt of contralateral prophylactic mastectomy in the community?

Findings

Attending surgeon explained a large amount (20%) of the variation in CPM. The estimated rate of CPM was 34% for surgeons who least favored initial breast conservation and were least reluctant to perform CPM vs 4% for surgeons who most favored initial breast conservation and were most reluctant to perform CPM.

Meaning

Attending surgeons exert strong influence on the likelihood receipt of CPM after diagnosis of breast cancer.

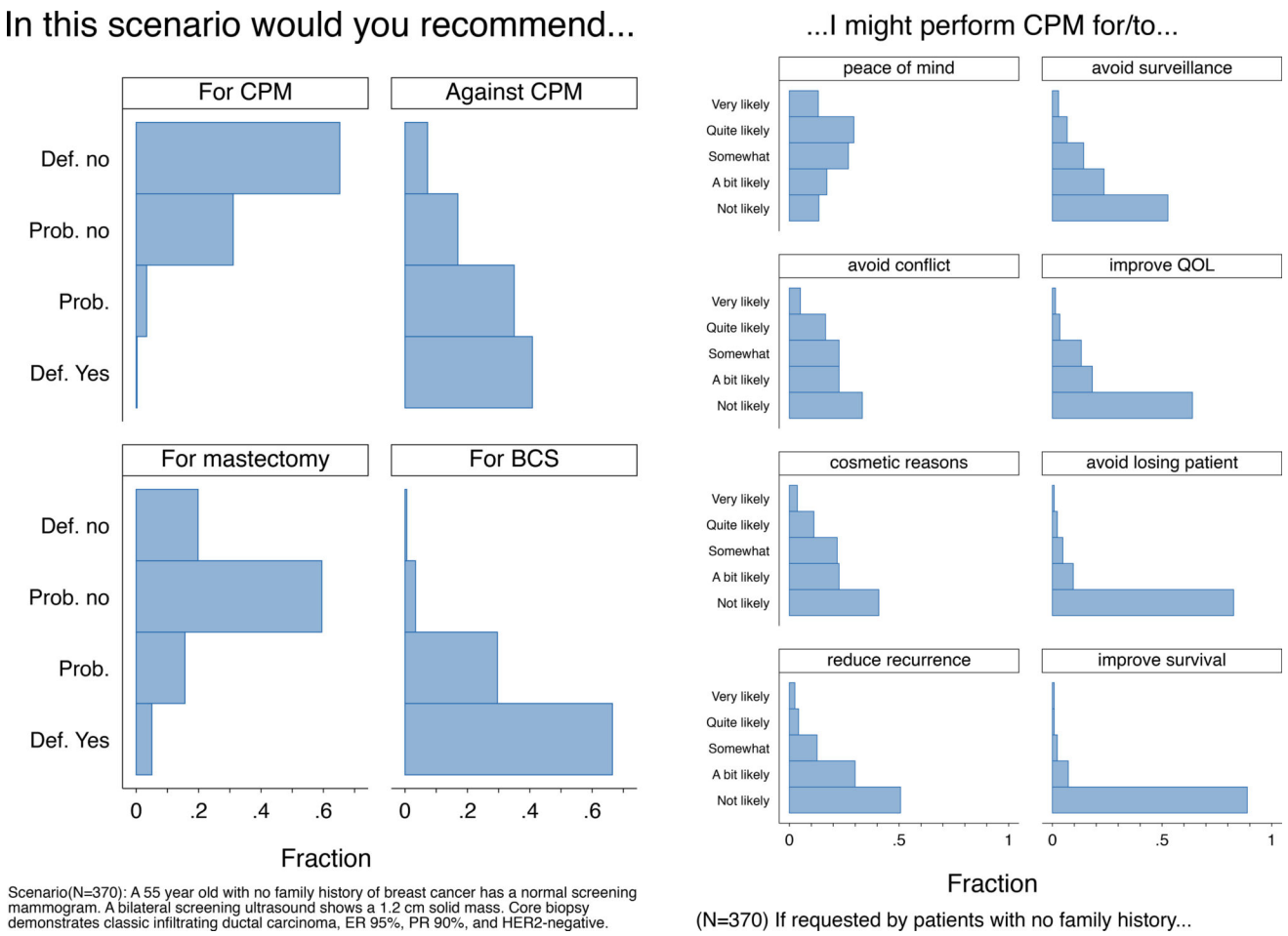

Figure 1.

Scale distribution scores. This figure shows the distribution of items used in creating the two scales. Both sets of items were elicited in response to a scenario described in the footnote on the left. On the left are four items used in creating the “favor breast conservation” scale. On the right are 8 items used in creating the “reluctance to perform CPM if requested” scale. These items referred again back to the scenario and further stipulated that this patient had no family history of breast cancer.

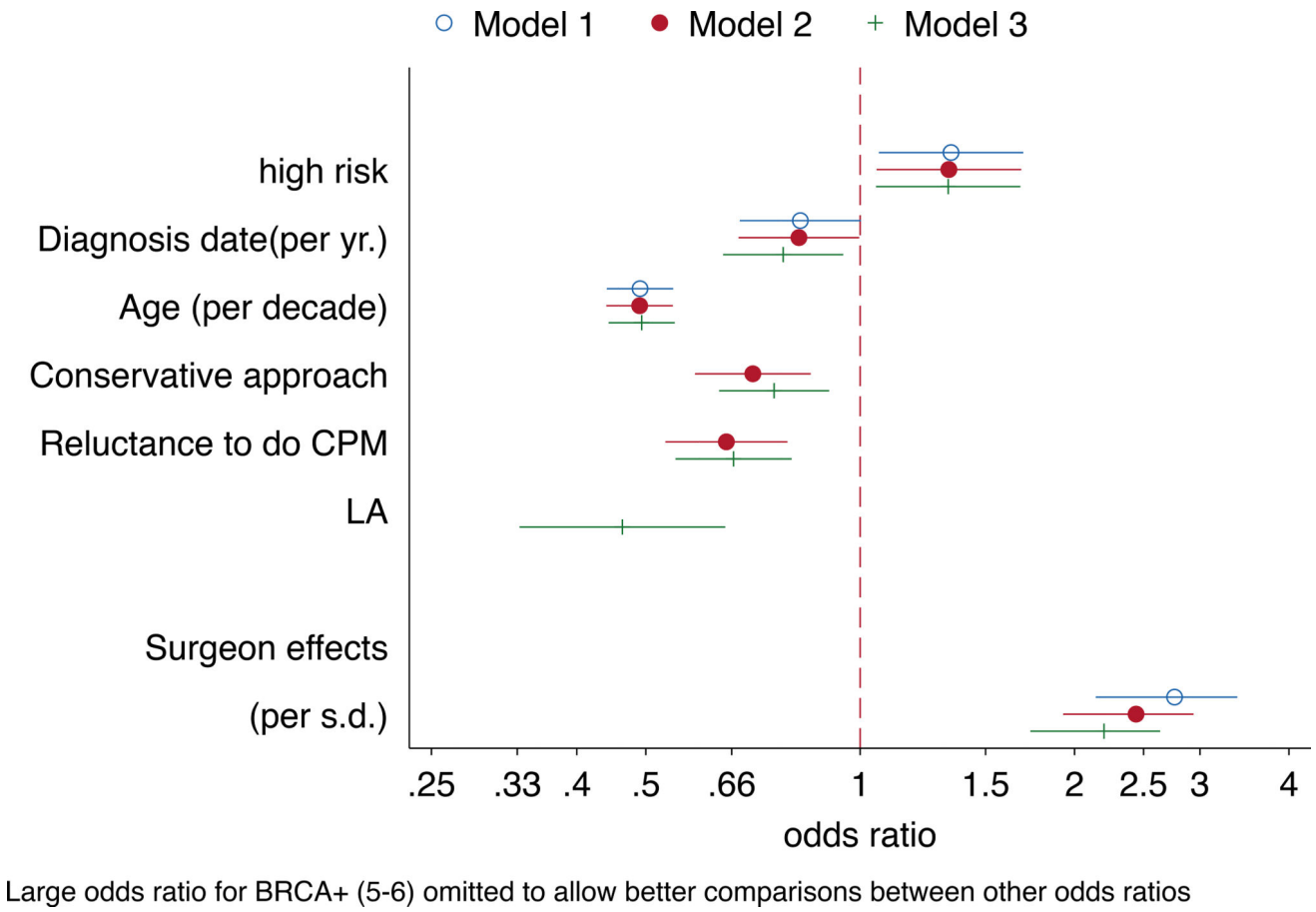

Figure 2.

Distribution and relationship of two scale scores. The “reluctance to perform CPM” scale score is on the x axis with the distribution of scale scores shown in the histogram at the top of the graph. The “favor breast conservation” scale is on the y axis, with the distribution of scale scores shown in the histogram over on the right side. The scatter plot of points representing individual surgeons demonstrates a relatively weak correlation between the two scale scores (0.30), suggesting that the scales measure distinct aspects of the surgeons’ practice approach. The descriptors “Least, Less, Average, More and Most” refer to −2, −1, 0, 1 or 2 standard deviations around the mean scale score for our sample of surgeons.

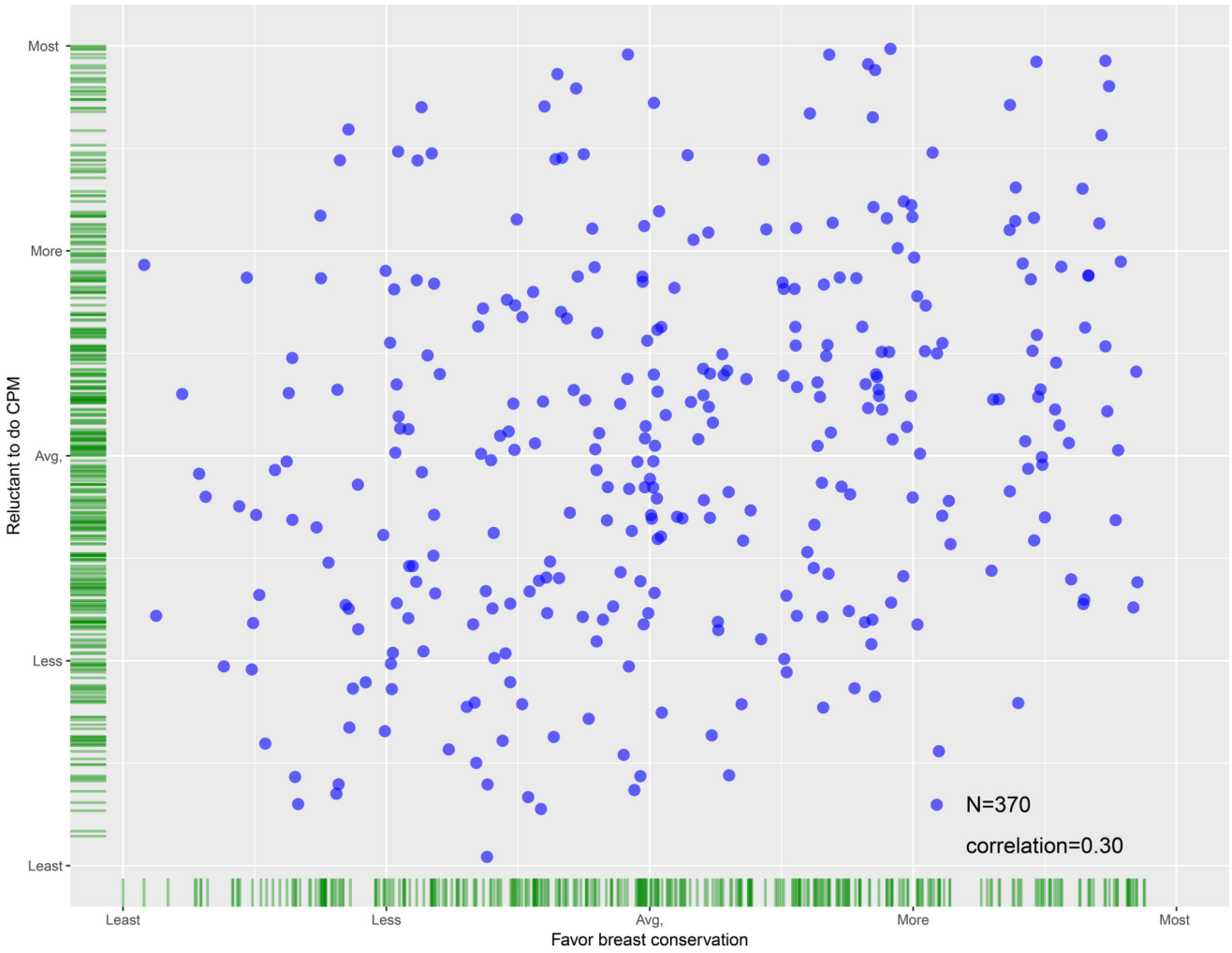

Figure 3.

Odds ratios (95% CI) for receipt of CPM from three models. This figure shows the estimated odds ratios for three successive multilevel logistic regression models. Model 1 (blue lines, open circles) is the baseline model in including patient factors that are mentioned by guidelines as possible indications for CPM as well as patient age. Model 2 (red lines, closed circles) adds the two surgeon scales describing their practice styles. Model 3 (green lines, cross) adds the location of the subjects and physicians (Los Angeles county vs Georgia). All models include a surgeon identifier and quantify the amount of surgeon variation that remains after including the variables in each respective model. The odds ratio listed for the surgeon effect represents the amount by which a patient's odds of CPM are multiplied if they see a surgeon with a propensity to do CPM one standard deviation above the average surgeon (or in other words a surgeon in the 84th percentile as opposed the 50th percentile for propensity to do CPM).

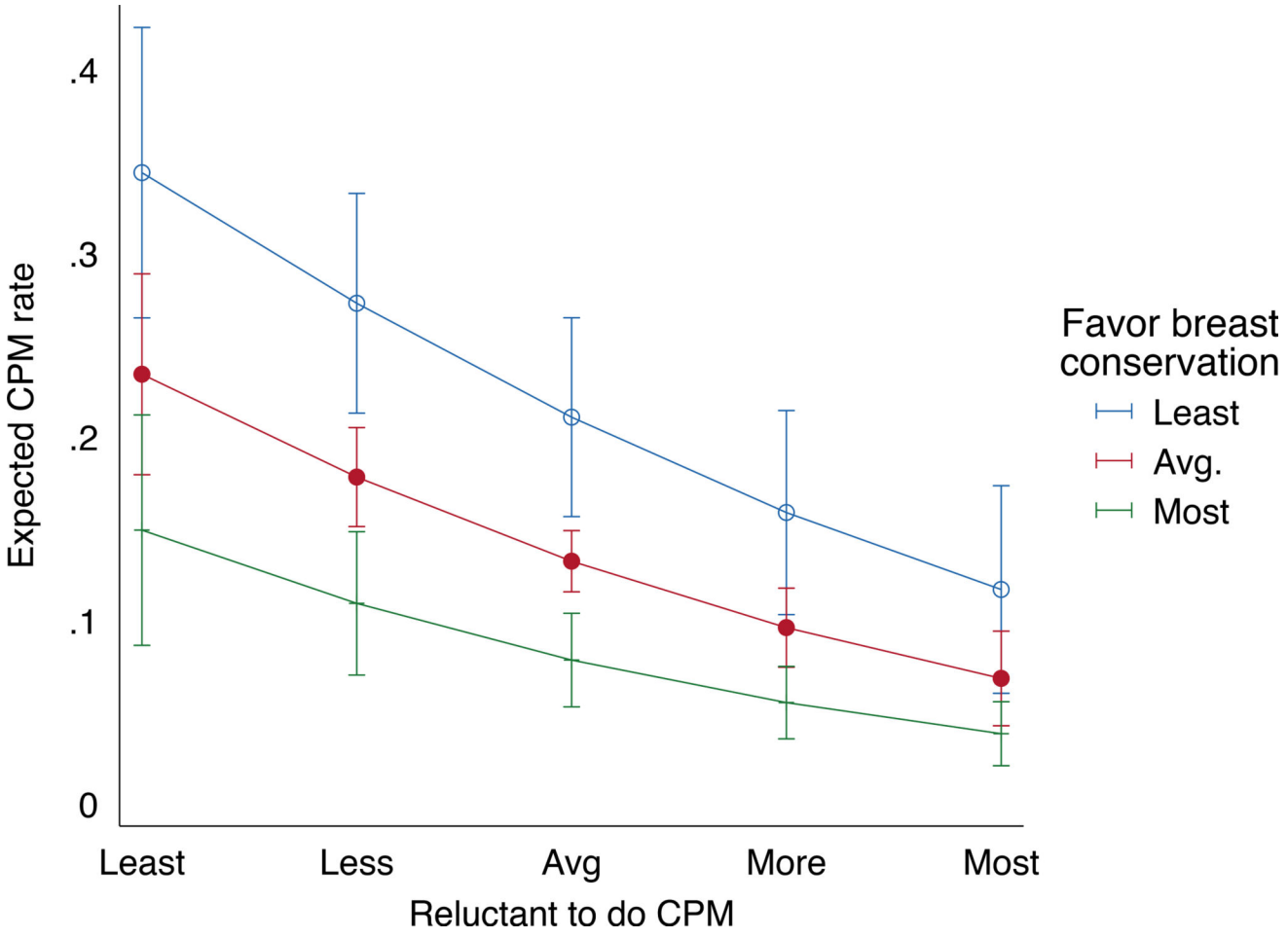

Figure 4.

Probability of CPM by surgeon practice approach. This figure describes the estimated marginal probability that a woman would receive CPM as a function of the two surgeon scales describing the practice approach of the surgeons in our sample. On the x-axis is the levels of the "reluctance to perform CPM" scale with the descriptors "Least, Less, Average, More and Most" referring to −2, −1, 0, 1 or 2 standard deviations around the mean scale score for the population. The three lines represent 2 standard deviations below to 2 standard deviations above the average scale score on the "favor breast conservation" scale. The y-axis shows the predicated average rate of CPM in the population from which we sampled, if the entire population were treated by a surgeon at any of the specified levels of the two scales. The estimates are averaged over BRCA status, risk of 2nd primary breast cancer, patient age, date of diagnosis and the residual surgeon differences (e.g. these are marginal predictions).

Table 1

a. Patient characteristics (N=3353)		
	N	**Mean (continuous) or % (categorical)**
Age (years)	3,353	61.9
Categorical variables		
Surgery type		
BCS	2,156	64%
Unilaterial Mastectomy	663	20%
Bilateral Mastectomy	534	16%
BRCA+ reported		
No	3,295	98%
Yes	58	2%
High risk		
No	2,401	72%
Yes	952	28%
Site		
Georgia	1,829	55%
LA County	1,524	45%
SEER stage		
DCIS	604	18%
Stage I	1,868	56%
Stage II	881	26%

b. Surgeon characteristics (N=349)		
	N	**Mean (continuous) or % (categorical)**
Surgeon age	339	53.9
Categorical variables		
Surgeon gender(%)		
Male	256	75%
Female	87	25%
Years in practice		
0-10 years	73	21%
11-20 years	96	28%
over 20 years	180	52%
Volume in past 12 months		
<=20 cases	129	38%
21-50 cases	109	32%
>50 cases	104	30%

Note: The total N=3262 reflects patients with complete data in all variables used in the analysis

Note: The total N=349 reflects the number of surgeons with complete data for the surgeon variables used in the analysis. Some of the demographic variables shown above have missing data and are provided for descriptive purposes here but are not used in the analysis.